Symptom Domains of Tourette syndrome:

Current therapeutic approaches:
Ph – Pharmacology
Su – Surgical (DBS and transcranial magnetic stimulation)
Bh – Behavioural (CBT, CBIT/HRT)
LR – Possible cause of learning-related difficulties

Symptom Domain		Ph	Bh	LR
Tics	Motor and vocal tic behaviours. Complex and simple tics. Su	*	*	*
	Many tic behaviours can appear to be integrated with obsessive-compulsive behaviours, especially complex tics, and the difference may not be discernable			
Attention Deficit	Impaired attention and concentration	*	*	*
	Can appear as one of the earliest symptoms in TS in young children before tics			
Hyperactivity	Hyperkinesis/high level of activity	*		*
	Rapid speech		*	*
	Verbosity/poor turn-taking in conversation (reciprocity)		*	*
	Can appear as one of the earliest symptoms in TS in young children before tics			
Depression	Low mood	*	*	
	Reduced concentration			*
	Common in a high percentage of individuals with TS			
Social Impairments	Theory of Mind difficulties (TOM)			*
	Literal thinking/understanding		*	*
	Impaired attribution of intention/use of touching		*	*
	Increased/disproportionate emotional responses (emotional volatility and sometimes rage)		*	*
	Speech difficulties – stuttering/blocking/dysfluencies		*	*
	Auditory processing dysfunction (can involve more reading of lips and other expressive cues)			*
	Distraction due to tics. Loss of conversational continuity			*
Sensory Integration	Sensory Processing Disorder symptomatology			*
	Sensory hypersensitivity: Can involve over-sensitivity to any sensory modality (tactile, auditory, visual, olfactory, vibration sense, temperature sense, taste)			*
	Sensory defensiveness or avoidance of 'unpleasant' or 'too intense' stimulation			*
	Many children find certain clothing uncomfortable			
	Preference for or avoidance of specific textures, materials and foods			
	Different modalities may interfere with others (may not be able to discern speech efficiently when watching visual images or reading, or not be able to read and write effectively if surrounded by excessive visual stimuli, activity or additional environmental noise)			*

	Poor volume awareness when speaking			
	Difficulty with flickering or pixelated screens – backlit displays sometimes impair reading ability. Higher definition displays can help in this instance. Difficulty with scrolling text or particular fonts.			*
Non-verbal Learning Difficulties (NLDs)	Slow reading and writing speed (typing and reading from screens may be similarly affected)		*	*
	Sensory integration difficulties (e.g can affect visual discrimination)			*
	Tics, obsessions and compulsions may interfere with studying/carrying out assignments within set time limits			*
	May take on too many simultaneous tasks			*
	May have difficulty in completing assignments or personal projects		*	*
	Individuals may compensate for NLDs with enhanced verbal abilities			
Other Learning Difficulties	As with all children/students/adult-learners, those with TS may also have learning difficulties and NLDs including dyslexia/dyspraxia/dysgraphia/dyscalcula etc. These appear to be more prevalent in individuals withTS		*	*
	The majority of individuals with TS fall into the average or even high range of IQ. TS itself does not appear to impair intelligence (or focused motor skills in most) and evidence suggests that compensatory changes may occur over time which may even enhance some cognitive and motor functions. However some do have motor skills deficits. Handwriting quality and drawing accuracy is sometimes affected. Some have gait abnormalities.			
Obsessive-Compulsive Behaviours	Ritualised activities/complex tic behaviours	*	*	*
	Unwanted or unsettling thoughts (may be contrary to the individual's personality/feelings)			*
	Obsessive thinking/thought tics (looping)			*
	Anxiety about other people/family/upcoming events/changes. Heightened empathic response			*
	Concerns about symmetry and evening-up, numerical ordering/preferencing (OCBs relating to washing/cleaning appear to be less common)			*
	Perfectionism (may lead to prolonged time spent on activities/tasks)			*
	Difficulties with writing, drawing and other tasks such as keyboard-use etc. due to OCBs			
Anxiety	Considered to be one of the most disabling symptom domains of TS	*	*	*
	Panic attacks		*	*
	Social anxiety and low self-esteem		*	*
Neuro-endocrine	Heightened stress response (evidence for increased cortisol concentrations)			
	Polyuria (increased diuresis/urine flow)			*

	Increased thirst response			
	Evidence for hypothalamic involvement including temperature dysregulation			
	A number of hormones/neurotransmitter substances show altered CNS or systemic concentrations (including dopamine, serotonin, histamine, nor-epinephrine, GABA, cortisol, dynorphin-A/beta-endorphin, gonadotrophin, lutenising hormone release-factor, opioid receptor responsivity and increased urinary amines)			
Sleep Dysfunction	Poor quality sleep	*	*	*
	Reduced sleep time			*
	Increased sleep disturbance/awakening and less REM sleep			*
Immunological	Some evidence for increased susceptibility to some infections (possible due to immunoglobulin deficiencies)			
	Enhanced inflammatory responsiveness			
	Possible allergies must be considered and ruled out			
	Many report an increase in other symptoms during illness e.g tics			*

Tourette syndrome Symptomatology:

Tourette syndrome does not have one 'specific' symptom profile that is represented in all individuals although the presence of motor tics for twelve months or more accompanied by 'vocal' tics is the defining feature in diagnosis. Some domains may be more represented in some or be of lesser significance in others. Evidence suggests that there may be several different 'phenotypes' of Tourette syndrome although these have proved difficult to define conclusively.

One of the most significant axes is the relationship between tic behaviours and obsessive-compulsive behaviours (OCB) which are recorded in 60% or more of those with TS. Much debate continues with respect to TS-related OCB/OCD and OCD. There are several perspectives. One is that TS and OCD are manifestations of a spectrum disorder with a common neuro-pathological/genetic origin. Another is that TS-related OCB is possibly intrinsic to TS itself but shares an area of over-lapping neuro-pathology, and thus symptomatology, with OCD.

It is also becoming more apparent that a possible relationship with autistic specrum disorder may exist. Although some people with TS also receive a diagnosis of ASD it is known that a high proportion of those with a primary diagnosis of TS have some symptoms that are shared with ASD and once thought to be characteristic only of ASD. These include 'Theory of mind' and social difficulties. However it should be noted that neuro-developmental 'disorders' such as TS, ASD, ADD, SPD etc. are mostly defined only by observed signs and symptom ‘sets’ and their underlying physiological or neuro-anatomical causes are unknown and thus no definitive investigative tests are available.

Sometimes responsiveness to specific medications may help increase the strength of a diagnosis. Many neurological and neuro-psychiatric disorders are diagnosed using numerical scoring algorithms based on a relatively subjective 'grouping' of symptoms. Much current work focuses on determining the actual neurophysiological aetiology of neuro-developmental conditions such as TS, autism (ASD), ADD/ADHD and SPD in order to establish better diagnostic definition that includes investigative pathology and so reduce the ambiguities of subjective/intuitive assessment.